

Authors

Karl J. Åström

Lund Institute of Technology, Lund, Sweden

Civ. eng. in Engineering Sciences, 1957, and tekn. lic. in Mathematics and Control Engineering, 1960, Royal Institute of Technology, Stockholm. During the academic years 1955–1960, he was instructor in mathematics, mathematical statistics, mechanics and control engineering at Royal Institute of Technology. He worked with analysis and design of inertial guidance systems from 1957–1960. Joined IBM Nordic Laboratory in Stockholm, 1961, to work with process control. He worked with optimal control and stochastic control problems as a visiting scientist at IBM Research in San Jose, 1962–1963. Appointed manager of the control systems theory group at IBM Nordic Laboratory in 1964 responsible for developing and implementing strategies for paper machine control. In July 1965 he was appointed professor of the chair of Automatic Control at Lund Institute of Technology, where he is now working. He is also consultant to the IBM Nordic Laboratory. Member, TFF and SIAM.

Kenneth R. Brown

Federal Systems Division, Cambridge, Massachusetts

A.B. in Mathematics, 1964, Harvard University. Joined IBM in 1964 and has worked on the development of guidance theory and computation techniques for the Saturn program. Currently, he is working toward a Ph.D. in Applied Mathematics at Harvard while on educational leave from IBM.

William J. Budurka

Federal Systems Division, Owego, New York

B.S. in Electrical Engineering, 1955; M.S. in Electrical Engineering, 1962; both at Lehigh University. Worked at Westinghouse Air Arm Division, Baltimore, from 1955–1958. Joined IBM in 1958 at the Federal Systems Division laboratory in Owego, and spent the school years 1960–62 on educational leave at Lehigh University. Has worked on simulation analysis studies for guidance and control of spacecraft and missile systems. Member, AIAA.

Albert Chang

Research Division, San Jose, California

B.S., 1960 and Ph.D., 1964, both in Electrical Engineering at the University of California, Berkeley. Prior to joining IBM he was an acting assistant professor at the University of California. Joined IBM in 1964 to work in the control systems group at San Jose on traffic control. Presently studying interconnected electrical power systems. Member, ACM, IEEE and Phi Beta Kappa.

Erik B. Dahlin

Data Processing Division, Control Systems Development Center, San Jose, California

M.Sc. in Technical Physics, 1952, Royal Institute of Technology, Stockholm; Ph.D. in Electrical Engineering, 1964, University of Pennsylvania. Before joining IBM, he was Manager of Systems Analysis with the Industrial Division of Honeywell, Inc. Joined IBM at San Jose in 1964 and has since worked on the development of control strategies for paper machines. His most recent work has been on the development of an optimization method for dispatch of hydro-power systems. Member, IEEE and SIAM.

Pieter D. Davidse

Components Division, East Fishkill, New York

B.S. in Chemistry, 1955; M.S. in Chemical Engineering, 1956; Ph.D. in Physical Chemistry, 1959, all at Delft Technological University. Was a staff member at Delft Technological University from 1955 to 1959. Has also worked at the Philco Scientific Laboratory, Blue Bell, Pennsylvania. In 1963 joined the IBM Components Division in Poughkeepsie, where he worked on rf sputtering techniques. Presently manager of sputtered insulator technology in the laboratory at East Fishkill. Member, American Vacuum Society.

Larry A. Gilson

Federal Systems Division, Huntsville, Alabama

B.S. in Electrical Engineering, 1961, Michigan State University; M.S. in Electrical Engineering, 1963, University of Michigan. Joined IBM in 1963 at the Space Guidance Center in Owego, New York, where he worked on simulation and analysis of guidance and control systems. At Huntsville he has participated in the design and analysis of attitude control systems for Saturn boosters. Presently manager of the Upated Saturn I Control Design Department, developing applications of digital control techniques to Saturn vehicles. Member Eta Kappa Nu, Tau Beta Pi and Sigma Xi.

Ebert F. Harrold

Federal Systems Division, Huntsville, Alabama

B.S. in Mathematics, 1964, Georgia Institute of Technology. Now, completing requirements for M.A. in Mathematics at University of Alabama (Huntsville Center). Joined IBM in April 1964 at Huntsville to work in the area of guidance and control analysis, with studies on the interaction of the guidance and control systems, quantization effects in control systems, and design/evaluation of digital controllers. Presently engaged in evaluation of control system performance by digital simulation. Member, SIAM.

George W. Johnson

Federal Systems Division, Cambridge, Massachusetts

B.E.E., 1950, Rensselaer Polytechnic Institute; M.S.E.E., 1954, and Ph.D., 1963, University of Connecticut. Previously instructor and assistant professor in Electrical Engineering at Rensselaer Polytechnic Institute and the University of Connecticut. Joined IBM in 1956 at Vestal, New York, and is now manager of computer control in the Federal Systems Division laboratory at Cambridge.

Frank G. Kilmer

Federal Systems Division, Huntsville, Alabama

B.S. in Electrical Engineering, 1955, Penn State University; M.S. in Electrical Engineering, 1956, Ohio State University. Joined IBM in 1956 at the Airborne Computer Laboratory in Vestal, New York as a control systems analyst. Later performed studies on a Doppler/inertial guidance system and ballistic missile flight control at the Space Guidance Center in Owego. At Huntsville has performed guidance and control analysis and presently is responsible for Saturn V control system analysis and simulation studies. Member, IEEE.

Herbert S. Lehman

Components Division, East Fishkill, New York

B.S. in Chemistry, 1957, Brooklyn College; M.S. in Physical Chemistry, 1960, Purdue University. Joined IBM in 1960 and has worked in the study of surfaces and surface passivation of semiconductor devices, and particularly the electrical, physical and chemical properties of oxide and glass systems on silicon devices. Is now at the Components Division Laboratories in East Fishkill. Member, American Chemical Society, RESA and PLU.

Leon I. Maissel

Components Division, East Fishkill, New York

B.Sc. Physics and Chemistry, 1949, M.Sc. in Physics, 1951, University of Cape Town, South Africa; Ph.D. in Physics, 1955, Imperial College, London. Worked at the Philco Corp. in Philadelphia, from 1956–1960 and joined IBM in August 1960. Currently manager of thin film technology at East Fishkill, working particularly on rf sputtering. Member of executive committee of Thin Film Division of the American Vacuum Society.

C. Dennis Mee

Systems Development Division, San Jose, California

B.Sc. in Physics, 1948, London External Nottingham University; Ph.D. in Physics, 1951, Nottingham University. Has worked in magnetic materials and magnetic recording at the Magnetic Research Laboratory of the Steel Company of Wales, the MSS Recording Company, Colnbrook, England, and the CBS Laboratories in Stamford, Connecticut. He joined IBM in 1962 at the Thomas J. Watson Research Center to work on magnetic devices. Transferred to San Jose in August 1965 and is now manager of the Advanced Technology department at the San Jose Laboratory. He received the IEEE Achievement Award in 1964 for outstanding contributions to magnetic recording. Fellow of the Institute of Physics and the Physical Society (England), and Senior Member, IEEE.

William A. Pliskin

Components Division, East Fishkill, New York

B.S. in Physics, 1941, Kent State University; M.S. in Physics, 1943, Ohio University; and Ph.D. in Physics, 1949, Ohio State University. Fellow at Ohio State University, 1948–49. Was a research physicist at Texaco Research Center, working on fundamental catalysis studies such as molecular surface structures determined by the infrared spectra of chemisorbed molecules. Joined IBM in 1959 at Poughkeepsie and has been engaged in structure and application studies of oxide and glass systems for surface passivation of silicon devices. Presently is manager of special studies of oxides and insulators at the East Fishkill laboratory. Member, Sigma Xi, Pi Mu Epsilon, Sigma Pi Sigma, American Physical Society, American Chemical Society, Electrochemical Society, and RESA; Senior Member, IEEE.

Howard M. Robbins

Federal Systems Division, Endicott, New York

B.S., 1947 and M.S., 1948, University of Minnesota; Ph.D., 1952, California Institute of Technology. From 1950–1960 was a systems analyst and senior engineer at Hughes Aircraft Co. Joined IBM in 1960, and presently heads the Space Systems Mathematical Analysis Department, Space Systems Center, Endicott. Experience has been in missile and space guidance, digital computer organization, computer applications analysis, systems analysis, numerical analysis, and optimal control.

Sanford M. Roberts

Federal Systems Division, Houston, Texas

B.S. in Petroleum Engineering, 1948, University of Pittsburgh; M.S. in Mechanical Engineering, 1950, University of California, Berkeley; Ph.D. in Chemical Engineering, 1954, Stanford University. Was a Research Fellow at the University of California, 1948–50; an instructor in Petroleum Engineering at the University of Oklahoma, 1950–51; and an instructor in Petroleum Engineering at Stanford University, 1952–54. Worked as a Research Engineer, Union Oil of California, 1953–58; then, as a Senior Process Control Analyst at Thompson-Ramo-Wooldridge 1958–61 and at Bonner and Moore, Houston, 1961–63. Joined IBM, Federal Systems Division, as an Advisory Mathematician at the Real-Time Computing Center, Houston, in 1963 to work in applied mathematics, two-point boundary value problems, optimization, and numerical analysis. Author of the book *Dynamic Programming in Chemical Engineering and Process Control*, Academic Press 1964, New York.

Jerome S. Shipman

Federal Systems Division, Houston, Texas

B.Ch.E., 1947, Rensselaer Polytechnic Institute; M.S. in Mathematics, 1950, New York University; M.A. in Mathematics, 1962, Harvard University. Vinyl ink chemist with Interchemical Corporation, Newark, 1948–51. Mathematician working on pulsed servos and radar problems with Laboratory for Electronics, Boston, 1951–56; RCA, Burlington, Massachusetts, 1956–60. Joined IBM Federal Systems Division in 1960 at the Cambridge Space Systems Department. Since 1963, has been Mathematical Development and Support Department Manager of the Real-Time Computing Center, Houston.

James E. Stuehler

Systems Manufacturing Division, San Jose, California

B.S. in Electrical Engineering, 1962, University of New Mexico. Presently working on M.S.E.E. at Stanford on the Honors Cooperative Program. Joined Lenkurt Electric in 1962 and worked in areas of carrier communications systems and data transmission systems. Was part time electronics instructor at College of San Mateo. Joined IBM in 1964, in the advanced technology group of Test Engineering at San Jose where he contributed to the system test design for the IBM 1800 System and participated in the design of the Computer Operated Manufacturing and Test System. Current interests lie in research and application of digital computer systems to control manufacturing process. Member, Eta Kappa Nu and IEEE.

Robert V. Watkins

Systems Manufacturing Division, San Jose, California

Was employed by U. S. Army Signal Corps as Radar Instructor 1942-1944 and as Electrical Engineer engaged in design of electronic test equipment for Radar and Communications equipment 1944-1957. Joined IBM San Jose Manufacturing plant in 1957 as Technical Engineer engaged in development of electrical test equipment. Is currently Staff Engineer in test engineering technology at the San Jose Plant working on development of computer systems for control of manufacturing and test operations.

• *Papers:*

Laser-pumped Stimulated Emission from Organic Dyes: Experimental Studies and Analytical Comparisons by P. P. Sorokin, J. R. Lankard, E. C. Hammond and V. L. Moruzzi.....	130
Flashlamp Excitation of Organic Dye Lasers: A Short Communication by P. P. Sorokin and J. R. Lankard.....	148
A 110-Nanosecond Ferrite Core Memory by G. E. Werner, R. M. Whalen, N. F. Lockart and R. C. Flaker.....	153
A Very-High-Speed, Nondestructive-Read Magnetic Film Memory by G. Kohn, W. Jutzi, Th. Mohr and D. Seitzer.....	162
Device and Array Design for a 120-Nanosecond Magnetic Film Main Memory by E. W. Pugh, V. T. Shahan, and W. T. Siegle..	169
Direct Digital Processor Control of Stepping Motors by T. R. Fredriksen.....	179
Digital Simulation Applied to a Photo-Optical System by R. B. Edwards, D. T. Hodges, Jr., W. D. Hopkins and D. P. Paris.....	189

• *Papers on Difference Equations:*

Foreword.....	213
On the Partial Difference Equations of Mathematical Physics by R. Courant, K. Friedrichs and H. Lewy.....	215
Hyperbolic Difference Equations: A Review of the Courant, Friedrichs, Lewy Paper in the Light of Recent Developments by P. D. Lax.....	235
On Difference Methods for Parabolic Equations and Alternating-Direction Implicit Methods for Elliptic Equations by O. B. Widlund.....	239
Elliptic Equations by S. V. Parter.....	244

• *Papers:*

- On the Mathematical Theory of the
Linearly-Graded P-N Junction
by *D. P. Kennedy and R. R. O'Brien* 252

- Precipitation of Phosphorus, Arsenic, and
Boron in Thin Silicon Foils
by *M. L. Joshi and S. Dash* 271

- On the Velocity of a Domain Wall in an
Applied Magnetic Field
by *W. Palmer and R. A. Willoughby* 284

- Characteristics of the Chain Magnetic Film
Storage Element
by *P. Geldermans, H. O. Leilich, and T. R. Scott* . . 291

- Design Considerations for the Chain Magnetic
Storage Array
by *S. A. Abbas, H. F. Koehler, T. C. Kwei,
H. O. Leilich, and R. H. Robinson* 302

- A Computer Model for Global Study of the
General Circulation of the Atmosphere
by *D. A. Quarles, Jr. and K. Spielberg* 312

• *Communication:*

- A New Current Instability in N-type Germanium
by *J. C. McGroddy and M. I. Nathan* 337

IBM

The IBM Journal of Research and Development is regularly indexed and abstracted by Science Abstracts (I.E.E.-Britain), Chemical Abstracts, The Engineering Index, Physikalische Berichte, ASM Review of Metal Literature, Mathematical Reviews, Computing Reviews, Computer Abstracts (Technical Information Co. Ltd.-Britain), Bulletin Signaletique (C.N.R.S.-France), Solid State Abstracts, Instrument Abstracts (British Scientific Instrument Research Association), Psychological Abstracts, Computer Abstracts on Cards, Automatic Subject Citation Alert, and American Documentation Institute. Reproductions of the magazine by years are available on positive microfilm from University Microfilms, 313 N. First Street, Ann Arbor, Michigan.